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ABSTRACT

Three applications of microcomputers in Elementary Algebra instruction are described. The paper first discusses a program developed to help students explore the basic algebraic concept of linearity. Text and illustrations show how students can use the computer to visualize the conceptual relationship of slope and intercept, until they can accurately predict a graph given an equation. Alternative options for students who have difficulty formulating questions or experimenting are mentioned. Next, the paper considers the value of computer-generated quizzes in mastery courses where students are retested until they meet a prescribed criterion. The paper explains that computer programs, made up of a control and response evaluation program and a library of subroutines, can generate an infinite number of similar quizzes. Finally, the use of computer-directed video tutorials is considered. After noting that the possibility of computer tutorials is affected by the time involved in developing dynamic and instructive displays, the paper argues for combining the image and sound capabilities of video with the response processing and control capabilities of the computer. Finally, the paper briefly explains how the student can use an APPLE computer in conjunction with a video cassette recorder. (AYC)

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An APPLE a day will keep the text away!

or

USING MICROCOMPUTERS IN ELEMENTARY ALGEBRA

by

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ABSTRACT

Three applications of microcomputers in Elementary Algebra will be described. Computer Directed Video Tutorials integrate video and computer response processing to form an interactive instructional system for remediation and primary instruction. Micro-based exploratory exercises aid in developing student skills and in insights. Computer generated topical quizzes, using item algorithms, enable individualized repeated testing.

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USING MICROCOMPUTERS IN ELEMENTARY ALGEBRA

Computer-based Concept Discovery and Exploration

For many students the personal discovery of a concept or development of an insight is both rewarding and promotes better retention of the concept. Based on these observations we have begun develoment of a series of programs that enable students to explore concepts in Elementary Aglebra.

The first program developed was for the linear function. In studying the linear function students usually learn about "slope" and "intercept". The meaning of these terms and their application to the graph of a straight line can be quickly discovered if the student can easily specify parameters and immediately see the graphic result.

Using an APPLE microcomputer, the student simply inserts a diskette into the disk drive and turns on the machine. After an introductory frame the student is presented with a display like figure 1.

By pressing the key associated with the first letter of the desired word in the command line at the top of the

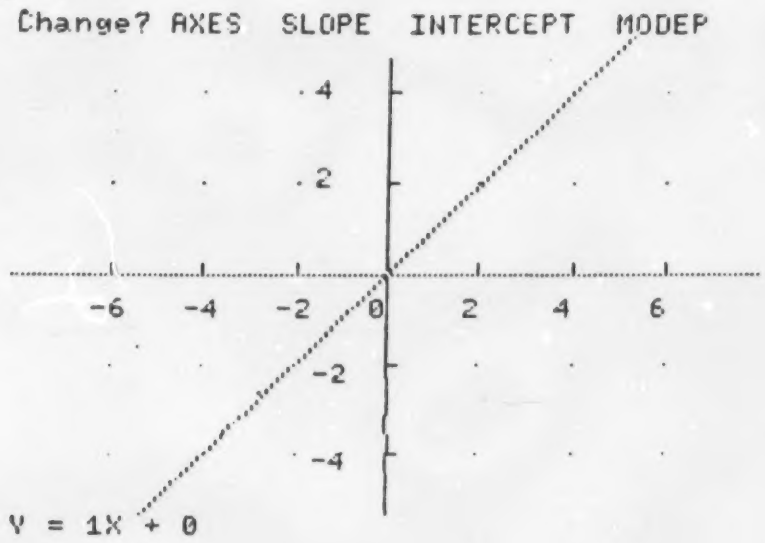

Figure 1

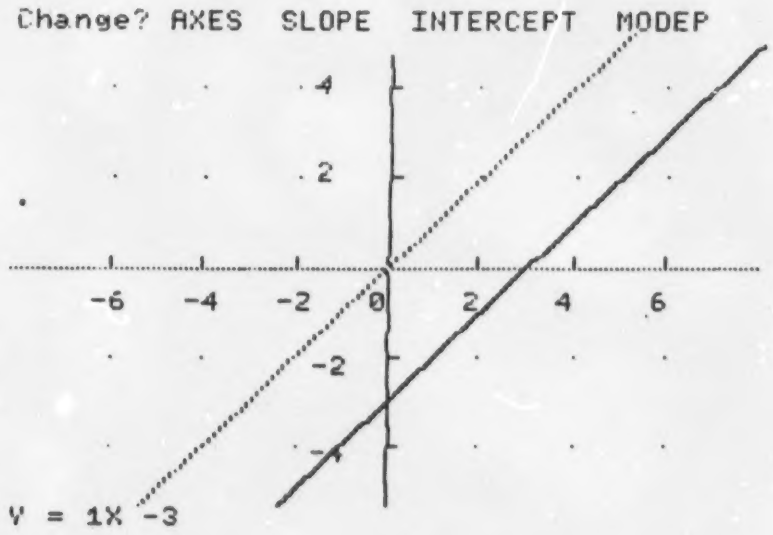

Figure 2

screen, the student is guided through the change process. For example, pressing an I brings a question: New intercept = ? Typing a -3 and pressing the <RETURN> key is followed almost immediately with a display like figure 2.

Notice that the equation in the lower left corner of the display always agrees with the most recently plotted line.

Students are encouraged to experiment with both the slope and intercept until they can accurately predict the graph, given the equation or vise versa. A set of work sheets aid the student in the experimental process. Figures 3 and 4 are examples of one student's continued development of the display.

For the student that has difficulty formulating questions or who simply does not want to experiment, we have developed an alternative program which uses the concepts of slope and intercept in a graphic game of "connect the dots". To "win" the game the student must learn to adjust the slope and intercept to produce the line that will connect the dots generated by the program.

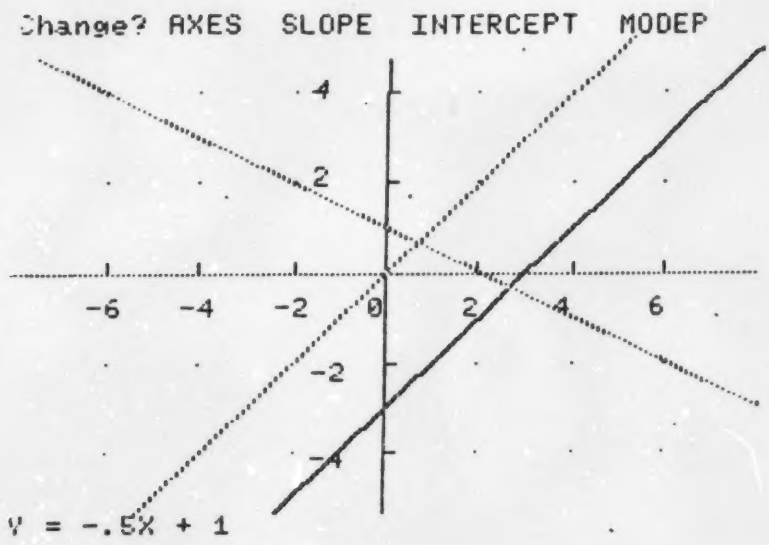

Figure 3

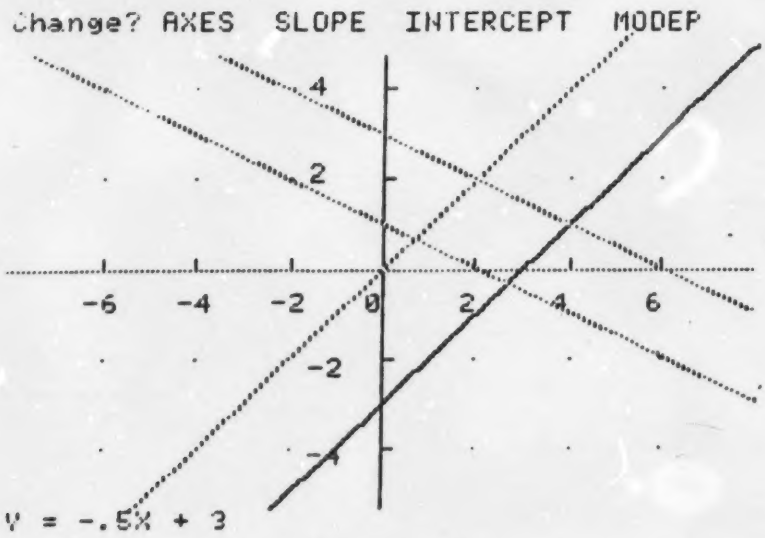

Figure 4

Computer Generated Quizzes

Testing of concept understanding or skill performance is another area where the computer is assisting. It is especially helpful when in a course operated on a mastery basis and students are required to retake exams or quizzes until they meet a prescribed criterion.

As a first step toward meeting this need we are developing a series of programs each of which will generate an indefinate number of similiar quizzes. To accomplish this each quiz program is made up of a control and response evaluation program and a library of subroutines. Each subroutine is a problem "stem" or skeleton and appropriate mechanics for changing variable conponents of the problem. For example, in

Factor: AX - BY + AX + C

A, B, and C are all comouter generated within limits provided by the program. The variables X and Y may becom W and V or other letter pairs allowed by te program. The order of the terms is another variable within the program. Thus with one relatively short subroutine a very large nunber of highly similiar problems can be generated.

Computer Directed Video Tutorials

Tutoring is another familiar component of the teaching/learning process. Students having difficulty, who have missed class, or who are proceeding at their own pace must seek assistance from peers, parents, or faculty.

It is also possible to use the computer as a tutor but the development of interactive programs that include dynamic and instructive displays is extremely time consuming. However, by combining the image and sound capabilities of video with the response processing and control capabilities of the computer the best of both technologies can be utilized with a minimum of effort.

Equipment which plugs into the APPLE will allow the program running in the APPLE to control a video cassette recorder (VCR). To use the Computer Directed Video Tutorial (CDVT) system (figure 5) a student places a video cassette in the VCR and starts a control program in the APPLE. After initialization and student log in, the control program operates the VCR and presents the student with a short segment of video. Either the video or the computer program may present questions to determine

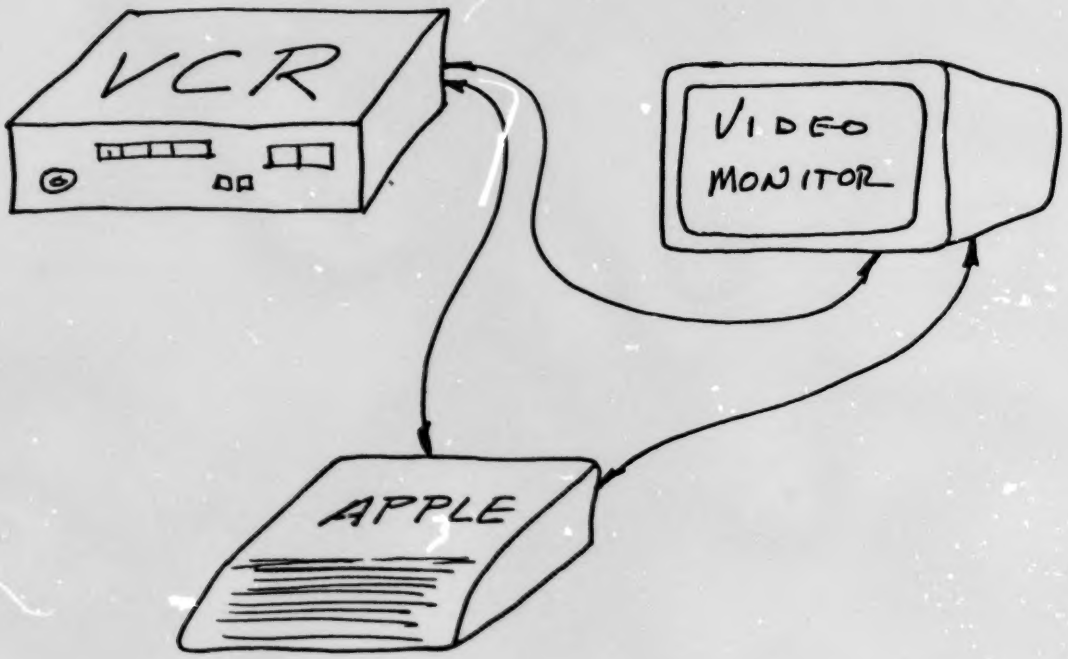

Figure 5

student understanding. The student supplies the answer thru the APPLE's keyboard. The program analyzes the answer. and based on the answer, the dialog continues with the next appropriate video sugment. The control program can logs student responses and these response records are used to track student progress and to aid in improving the tutoring system. Our initial experience with CDVT indicates that it has considerable potential for providing individualized assistace to students.

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